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Find Subject Areas:

[Show Side Menu](#) **Search Subject Areas & Legacy Documents:**

Contents: Personal Protective Equipment

Effective Date: **November 2003**

Point of Contact: [Personal Protective Equipment Subject Matter Expert](#)

Section

Overview of Content (see section for full process)

[Introduction](#)

[1. Planning for and Preparing to Use Personal Protective Equipment](#)

- Investigate engineering and administrative controls before selecting PPE.
- Perform a job assessment to determine the need for PPE.
- Evaluate the hazard, potential exposure, and feasible proactive equipment.
- Select personal clothing for the operation.
- Select equipment that meets design specifications.
- Post a warning of the hazard and the PPE required for entry or work.
- Ensure users complete appropriate training.
- Obtain PPE or verify personal clothing is adequate.
- Obtain prescription eye protection equipment meeting ANSI standards.
- Obtain safety shoes meeting ANSI standards.
- Obtain fall protection equipment meeting ANSI standards.

[2. Obtaining, Procuring, and Purchasing Personal Protective Equipment](#)

[3. Using and Disposing of Personal Protective Equipment](#)

- Inspect the PPE to verify its integrity.
- Wear and maintain the equipment as per training and manufacturer's instructions.
- Clean reusable equipment.
- Store equipment in a sanitary manner.
- Dispose of protective equipment.
- Report any problems using PPE or suggest improvements.

[Definitions](#)

Exhibits[BNL Handbook on Personal Protective Equipment](#)[\(PPE\) Selection and Use](#)[Generic Hazard Assessments](#)[Specific Hazard Assessments](#)**Forms**[Protective Clothing Selection Form](#)[Safety Shoes or Glasses Authorization - BNL Form #2211](#)

Training Requirements and Reporting Obligations

This subject area contains training requirements. See the [Training and Qualifications](#) Web Site.

This subject area does not contain reporting obligations

References

29 CFR 1910.132 – 140, Personal Protective Equipment

ANSI Z41: American National Standard for Personal Protection-Protective Footwear

ANSI Z87.1: American National Standard for Occupational and Educational Eye and Face Protection

ANSI Z89.1: American National Standard for Industrial Head Protection

ANSI Z359 American National Standard for Fall Protection

[BNL Supplier Nonconformance \(BSNC\) Reporting and Tracking System](#), [Procurement and Property Management](#) web site (*Limited Access)

[ES&H Standard 1.5.0, Electrical Safety](#)

Forsberg, Krister, & Mansdorf, S. Z. (1997). *Quick Selection Guide to Chemical Protective Clothing* (3rd ed.). New York: Van Nostrand Reinhold.

[Laser Safety](#) Subject Area

[Lead](#) Subject Area

[Noise and Hearing Conservation](#) Subject Area

[Respiratory Protection](#) Subject Area

[Training and Qualifications](#) Web Site

[Work Planning and Control for Experiments and Operations](#) Subject Area

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Standards of Performance

All staff and users shall identify, evaluate, and control hazards in order to ensure that work is conducted safely and in a manner that protects the environment and the public.

All staff and users shall ensure that they are trained and qualified to carry out their assigned responsibilities, and shall inform their supervisor if they are assigned to perform work for which they are not properly trained or qualified.

Management System


This subject area belongs to the **Worker Safety and Health** management system.

[Back to Top](#)

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1.1-012004/standard/2r/2r00t011.htm

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Introduction: Personal Protective Equipment

Effective Date: **November 2003**

Point of Contact: [Personal Protective Equipment Subject Matter Expert](#)

This subject area provides an overview of the BNL Personal Protective Equipment (PPE) Program and sets forth the elements to implement the regulatory requirements in OSHA Title 29 of the Code of Federal Regulations Part 1910.132-140.

The purpose of this subject area is to establish requirements on personal protective equipment (for body, eyes, face, head, feet, and hands) in operations with chemical, physical, or biological hazards. It also provides guidance for equipment used for respiratory protection and hearing protection; requirements for those subjects are addressed in the [Respiratory Protection](#) and [Noise and Hearing Conservation](#) Subject Areas. This subject area does not address the following hazards, which are covered in detail in other documentation:

- Radiological hazards (see SBMS subject areas);
- Fire Fighting (see ESD-level documents);
- [Laser Safety](#) (see subject area).

As the last line of defense against workplace hazards, Personal Protective Equipment (PPE) is used when engineering and administrative controls are not feasible, or as an interim measure while controls are being implemented.

The BNL Personal Protective Equipment Program contains the following provisions:

- Investigating alternative control measures, including engineering and administrative controls;
- Evaluating the work conditions to prescribe the correct personal protective equipment;
- Selecting the personal protective equipment to achieve maximum protection levels;
- Training users and supervisors in the elements of the program and personal protective equipment fundamentals as appropriate for the hazard and PPE;
- Establishing parameters for the use and control of personal protective equipment;
- Providing for decontaminating, sanitizing, maintaining, and repairing equipment to ensure maximum protection.

This subject area applies to "mandatory" uses of PPE (i.e., when PPE use is required to control exposure levels for regulatory compliance, or by management decision). When employees request to use personal protective equipment in situations where the use is not

required, the use is considered "voluntary." The hazard assessment provisions of this subject area do not apply to "voluntary" use of PPE, but the training, equipment inspection, and equipment cleaning provisions of this subject area do apply as appropriate. "Voluntary" use is allowed in situations where the "voluntary" use of personal protective equipment does not increase the exposure to other hazards.

- Example scenario: "Voluntary" use would be permitted for an employee desiring to wear earplugs around noise sources that do not exceed regulatory limits.


This subject area has limited applicability to "product protection" use of PPE (i.e., the use of PPE includes gloves, masks, and body suit used solely to protect the product being handled). Examples are clean room gowns and gloves in electronic component assembly. The hazard assessment provisions of this subject area do not apply to "product protection" use of PPE. The training, equipment inspection, and equipment cleaning provisions of this subject area do apply as appropriate when the use of the PPE introduces or increases worker hazards.

[Back to Top](#)

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Find Subject Areas:

[Show Side Menu](#) **Search Subject Areas & Legacy Documents:**

Subject Area: **Personal Protective Equipment**

1. Planning for and Preparing to Use Personal Protective Equipment

Effective Date: **November 2003**

Point of Contact: [Facility Support Representative](#) or [Industrial Hygiene \(IH\) Representative](#)

Applicability

This information applies to BNL staff and non-BNL staff who plan operations where personal protective equipment (PPE) will be used.

Required Procedure

The following steps must be taken before staff proceed with work requiring PPE:

Step 1	Prior to selecting PPE, Supervisors, Work Planners, Principal Investigators, or other appropriate personnel investigate engineering and administrative controls (see the Work Planning and Controls for Experiments and Operations Subject Area).
Step 2	Supervisors, Work Planners, Principal Investigators, or other appropriate personnel perform a job assessment to determine the need for PPE and the acceptable equipment specifications by: <ul style="list-style-type: none"> • Following the exhibit Generic Hazard Assessments, the exhibit Specific Hazard Assessments, or guidance from the BNL Handbook on Personal Protective Equipment (PPE) Selection and Use, or • Contacting an ESH Coordinator or Facility Support Representative, or • Reviewing Work Planning & Control documentation or Radiological Work Permit (RWP) that specifies personal protective equipment based on SME consultation, or • Completing a Personal Protective Equipment Selection Form, or • Following a Standard Operating Procedure (SOP) or other documentation.
Step 3	Supervisors, Work Planners, Principal Investigators, or other appropriate personnel evaluate the hazard, potential exposure, and feasible proactive equipment. PPE must be used when engineering controls and administrative

equipment. PPE must be used when engineering controls and administrative controls have not eliminated exposure. Protection requirements for specific tasks are based on the hazards associated with that activity including:

- Body, arms, and legs
 - Flying particles, molten metal, sparks, sharp objects, chemicals, harmful temperature extremes, and cryogens; or
 - injurious light radiation (e.g., UV and IR).
- Eye and face
 - Flying particles and objects, chemicals, cryogens, and injurious light radiation (e.g., UV and IR).
- Footware
 - Falling, rolling, handling heavy objects, piercing objects, electrical hazards, chemicals, slippery surfaces, or temperature extremes.
- Head
 - Flying or falling objects, overhead obstruction, areas where equipment protrudes into the work path, low overheads (less than 6'8"), work beneath conveyors, or high-voltage equipment.
- Hands
 - Harmful substances that can be absorbed through intact skin, cuts, lacerations, abrasions, and punctures;
 - chemical burns, thermal burns, molten metals, sparks, electrical hazards; or
 - harmful temperature extremes.
- Ear (hearing)
 - Noise levels above 85 dBA. Follow the [Noise and Hearing Conservation](#) Subject Area.
- Respiratory system
 - Hazardous atmospheres exceeding the occupational exposure limits. Follow the [Respiratory Protection](#) Subject Area.
- Falls
 - Working on elevated surfaces or scaffolding greater than six feet.
 - Striking a lower object in the event of a fall.

Step 4

Supervisors, Work Planners, Principal Investigators, or other appropriate personnel select personal protective equipment-based guidance in the [BNL Handbook on Personal Protective Equipment \(PPE\) Selection and Use](#), the exhibit [Generic Hazard Assessments](#), and the exhibit [Specific Hazard Assessments](#), or the following apply:

- **Casual, open-toed shoes** are not allowed for work with the hazards listed above in step 3.
- **Enclosed footwear (substantial)** do not provide impact-resistance protection. They provide protection from initial brief contact with chemicals and hot objects when worn with socks. They are not for use in areas with impact potential or for material handling.
- **Casual dress clothing** (short pants, short dresses, etc.) is not allowed for work with the hazards listed above in step 3.

	<ul style="list-style-type: none"> • Low-hazard protective clothing (includes BNL-supplied uniforms, long pants, long- or short-sleeved shirt, long dress, or skirt to the ankles) is the minimum protection level for incidental exposure hazards. Long sleeves or lab coat are needed when corrosive or high hazard chemicals are handled. <p>Note: Moccasins, sandals, or other open footwear are not considered substantial footwear.</p>
Step 5	<p>Supervisors, Work Planners, Principal Investigators, or other appropriate personnel select only equipment that meets design specifications and has the manufacturer's ANSI standard compliance marking:</p> <ul style="list-style-type: none"> • Eye and face protection required for impact protection must be marked as meeting ANSI Z87.1 standards. • "Impact resistant" footwear must be marked as meeting ANSI Z41 standards. • Impact resistant headwear must be marked as meeting ANSI Z89.1 standards. • Fall protection equipment must be marked and comply with ANSI Z359 requirements.
Step 6	<p>Where entry or work in the area requires PPE, Supervisors or designees must post a warning of the hazard(s) and the PPE required (e.g., hard hats in crane use).</p>
Step 7	<p>Supervisors identify required training needs and ensure personnel complete the training. Examples include</p> <ul style="list-style-type: none"> • Electrical safety; • Fall protection; • Hearing Conservation Program as described in the Noise and Hearing Conservation Subject Area; • Respiratory protection as described in the Respiratory Protection Subject Area; • Chemical protective clothing when body, hand, eye, head, and/or foot protection equipment is used for severe exposure potential work. <p>See the Training and Qualifications Web Site for courses.</p>

Guidelines

The [BNL Handbook on Personal Protective Equipment \(PPE\) Selection and Use](#) provides descriptions on the types of protective equipment that are available for use.

Consult the [Respiratory Protection](#) Subject Area for BNL procedures to select, obtain, use, and maintain respiratory protection personal protective equipment.

Consult with the [Industrial Hygiene \(IH\) Representative](#) for assistance on the manufacturer's recommendations regarding compatibility and limitations of the PPE.

Bump caps only provide protection where there is a potential for "striking against" other objects; they are not intended for use where there is potential exposure to falling objects.

Safety glasses should be ordered with side protection. Detachable sideshields are acceptable if they comply with ANSI Z87.1 requirements.

Contact lenses may be worn in most work environments provided the same approved eye protection is worn as is required of other workers in the area. Some limitations may apply to use in operations when certain gas, vapors, and particulates are present above occupational exposure limits. Consult with the [IH Representative](#) in these instances.

For some specialized work activities (such as welding), additional assessment of the specific hazard may need to be conducted in order to select the appropriate type of eye and/or face protection.

When protective footwear is required, the minimum level of protection should provide a high degree of stability, support, and protection from lacerations, punctures, and moderate chemical splashes.

References

ANSI Z41: American National Standard for Personal Protection-Protective Footwear

ANSI Z87.1: American National Standard for Occupational and Educational Eye and Face Protection

ANSI Z89.1: American National Standard for Industrial Head Protection

ANSI Z359: American National Standard for Fall Protection

[Noise and Hearing Conservation](#) Subject Area

[Respiratory Protection](#) Subject Area

[Training and Qualifications](#) Web Site

[Work Planning and Controls for Experiments and Operations](#) Subject Area

| [Continue to Next Page](#) |


[Back to Top](#)

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Find Subject Areas: Index Categories Alpha

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Subject Area: **Personal Protective Equipment**

2. Obtaining, Procuring, and Purchasing Personal Protective Equipment

Effective Date: **November 2003**

Point of Contact: [ESH Coordinator](#)

Applicability

This information applies to all staff, guests, and visitors who select or wear personal protective equipment (PPE), or who are responsible for activities that involve the use of PPE.

Required Procedure

The following steps must be taken before personnel proceed with work requiring PPE protection:

Step 1	<p>Staff purchases or obtains PPE.</p> <ul style="list-style-type: none"> ✍ PPE that is categorized as Low (A3 - Minor) or Negligible (A4 - Negligible) ESH&Q Risk Level (see the exhibit Screening Guidelines for Work Planning & Control and Application of the Quality Graded Approach in the Work Planning and Control for Experiments and Operations Subject Area) can be purchased with a credit card. Examples are aprons, lab coats, gauntlets, gloves, nonprescription safety glasses, disposable suits, and hard hats. ✍ PPE that is categorized as Moderate (A2 - Major) or High (A1 - Critical) ESH&Q Risk Level (see the exhibit Screening Guidelines for Work Planning & Control and Application of the Quality Graded Approach in the Work Planning and Control for Experiments and Operations Subject Area) is considered "Restricted" and cannot be purchased with a credit card. These include <ul style="list-style-type: none"> ✍ Fall protection harnesses, lines, and accessories; ✍ Respiratory Protection supplied air compressor, masks, fittings, lines, air quality monitoring components, and accessories; ✍ Grade D breathing air cylinders; ✍ Respiratory protection face pieces and hoods; ✍ Electrical flash suits;
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	<ul style="list-style-type: none"> ⚡ Level A chemical protective suits. ⚡ Additionally, these A1/A2 PPE items <ul style="list-style-type: none"> a. Must be procured only from sources qualified by Procurement and Property Management (PPM) and a knowledgeable ESH professional. b. Must be inspected and/or tested on receipt by the respective Subject Matter Expert (SME).
Step 2	Obtain PPE from the Supervisor, ESH Coordinator , or the organization's stockroom. PPE may be obtained from the PPM stockroom or other management-approved sources. When personnel provide their own clothing (such as casual dress and non-safety shoes), the Supervisor verifies that the personal clothing is adequate for the job before it is used.
Step 3	Obtain prescription eye protection equipment from the PPM stockroom (see Safety Shoes or Glasses Authorization - BNL Form #2211). Note: Prescription eye protection/safety glasses are considered a "Restricted" item by Procurement and Property Management and cannot be purchased with a credit card.
Step 4	Obtain safety shoes from the PPM stockroom (see Safety Shoes or Glasses Authorization - BNL Form #2211). Note: Safety shoes are considered a "Restricted" item by Procurement and Property Management and cannot be purchased with a credit card.
Step 5	Obtain fall protection equipment (that is approved by the Safety Engineering Group) from the responsible organization, or other sources, provided that the equipment is marked as meeting ANSI Z359.1 standards.

References

ANSI Z41: American National Standard for Personal Protection-Protective Footwear

ANSI Z87.1: American National Standard for Occupational and Educational Eye and Face Protection

ANSI Z359: American National Standard for Fall Protection

[Work Planning and Control for Experiments and Operations](#) Subject Area

| [Go to Previous Page](#) | [Continue to Next Page](#) |

[Back to Top](#)

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Show Side Menu Search Subject Areas & Legacy Documents:

Subject Area: **Personal Protective Equipment**

3. Using and Disposing of Personal Protective Equipment

Effective Date: **November 2003**

Point of Contact: [ESH Coordinator](#)

Applicability

This information applies to staff, guests, visitors, and contractors who select or wear protective equipment, or who are responsible for activities that involve the use of personal protective equipment (PPE).

Required Procedure

The following steps must be taken before personnel proceed with work requiring PPE:

Step 1	<p>Inspect the PPE to verify its integrity before using, wearing, and maintaining the equipment.</p> <ul style="list-style-type: none"> Inspect equipment for excessive wear, cuts, or other damage before use. Prior to using chemical-resistant gloves, examine the glove for pinholes, cracks, or weak areas by inflating the glove and trapping air in the palm and fingers. Before using a hard hat, check suspension system and the shell for cracks, dents, signs of wear, damage, excessive dirt, grease, and/or chemicals. <p>If PPE is defective, repair or replace it. If the equipment is defective because of a supplier-related defect, notify Procurement and Property Management (PPM) via the BNL Supplier Nonconformance (BSNC) Reporting and Tracking System.</p>
Step 2	<p>Wear and maintain PPE as per training and manufacturer's instructions during use.</p>
Step 3	<p>Clean reusable PPE using an appropriate cleaning technique.</p> <ul style="list-style-type: none"> Clean the interior of body protective equipment shared among multiple

	<p>users (e.g., Level A suits) following the manufacturer's recommended method.</p> <ul style="list-style-type: none"> • Use a commercial laundry (not home washing) for lab coats, coveralls, fire-protective clothing, and BNL-provided uniforms contaminated by a hazardous substance. • Clean (or use barriers) on equipment that is shared among multiple users (e.g., visitor hard hats, visitor glasses, and earmuffs) using alcohol wipe pads, band liners, paper towel liners, soap and water, or similar methods. • Do not share earplugs or canal caps between users. Discard dirty earplugs and canal caps.
Step 4	<p>Store PPE in a sanitary manner.</p> <p>Store fall protection equipment in a dry location, out of direct sunlight in accordance with manufacturer's instructions.</p>
Step 5	<p>Dispose of protective equipment according to guidance from the Waste Management Representative or Environmental Compliance Representative.</p>
Step 6	<p>Discard and replace fall protection equipment components after a fall incident as per the manufacturer recommendation. Contact the ESH Coordinator to have the equipment evaluated before continuing to use it.</p>
Step 7	<p>Inform the Supervisor, ESH Coordinator, or Facility Support Representative of any problems encountered in using PPE, or to suggest improvements to the BNL program.</p>

Guidelines

Guidelines on preventing heat stress when PPE (covering all or most of the body) is worn are provided in the web-based training module Heat Stress (see the [Training and Qualifications Web Site](#)).

References

[BNL Supplier Nonconformance \(BSNC\) Reporting and Tracking System](#), [Procurement and Property Management](#) web site (*Limited Access)

[Training and Qualifications](#) Web Site

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[Back to Top](#)

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BNL Handbook on Personal Protective Equipment (PPE) Selection and Use



1.0/2r01e011.pdf



1

Page 15 of 62



(11/2003)

BNL Handbook on PPE Selection and Use

Date: DRAFT

Contact: PPE Subject Matter Expert

Contents

Introduction

Section 1. Body (Torso) Protection

- A. Types of Protective Equipment

Section 2. Eye and Face Protection

- A. Types of Protective Equipment
- B. Filter Lenses for Protection Against Radiant Energy
- C. Markings for ANSI-Compliant Eye Protection

Section 3. Fall Protection

- A. Types of Protective Equipment

Section 4. Foot Protection

- A. Types of Protective Equipment

Section 5. Hand Protection

- A. Types of Protective Equipment
- B. Glove and Suit Selection Process
- C. Permeation Resistance/Degradation Tables
- D. BNL Guidance on “Splash Protection and Incidental Contact Gloves” for laboratory and fine detail work

Section 6. Head Protection

- A. Types of Protective Equipment

Section 7. Hearing Protection

- A. Types of Protective Equipment

Section 8. Respiratory Protection

- A. Types of Protective Equipment

Section 9. Generic and Specialized Task Hazard Assessments

- A. Generic Hazard Assessment
- B. Specialized Task Hazard Assessment

Introduction

This document is an accompanying reference to the Personal Protective Equipment Subject Area. It provides information for selecting PPE for generic and some specific work scenarios at BNL. The recommendations in this handbook are based on historical experience, professional judgment of the Personal Protective Equipment Subject Matter Expert, and published references.

Personal Protective Equipment is a component of the “hierarchy of controls” used to eliminate or reduce hazards in the workplace. The order in which the controls should be evaluated and used is:

1. **Eliminate the hazard**, examples
 - Use a different less dangerous piece of equipment
 - Fix faulty machinery
 - Redesign the workplace
 - Use safer materials or chemicals
2. **Engineering Controls** (isolate the hazard from the people), examples
 - Use guards around moving parts
 - Remove dust or fumes with an exhaust system
 - Use lifting equipment
3. **Administrative Controls** (change the way the job is done), examples
 - Rotate workers to shorten the time of exposure to any one employee
 - Spread the work out over more days to lessen the daily exposure
 - Provide training, information and signs
4. **Personal Protective Equipment (PPE)**
 - Wear PPE to isolate the worker from the hazard while other controls are being implemented.
 - Wear PPE to isolate the worker from the hazard when other controls are not feasible.




The least desirable and usually the least effective method of controlling a risk is the wearing of PPE. This method relies on employees wearing the equipment and then on the equipment always being available in good condition. Because the hazard has typically not been removed, the employee may be exposed to the potential danger if the PPE fails or is improperly used.

1. Body Protection





If you have any questions about the appropriate type of body protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

For guidance on selection of suit material, see Polymer selection guidance in *Section 5 Hand Protection*. For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments*.




1A: Types of Protective Equipment

Equipment Title	Description	Illustration
Casual dress clothing	Short pants, short sleeve shirt, short dresses, etc. Exposed parts of body are arms and legs. Offers very minimal to no protection level for incidental exposure hazards.	
Low-hazard protective clothing	Provides a minimum protection level for incidental exposure hazards. Consists of long pants and long or short sleeve shirt. Also meeting this category is a long dress or skirt to the ankles. Long sleeves or lab coat are needed when corrosive or high hazard chemicals are handled.	
Lab coat	Cotton or synthetic fiber long sleeve coat, open at the collar, covering to knee length. Provides initial splash protection, minimal thermal protection, and some abrasion protection. Must be removed immediately if contact with a hazardous substance occurs that can transmit the hazard to the underlying skin. Lab coats with red collars and yellow colored lab coats are reserved for work with radiological hazards.	

1A: Types of Protective Equipment

Equipment Title	Description	Illustration
Coveralls	Reusable or disposable one-piece suit. Provides initial splash protection, some thermal protection, and some abrasion protection.	
Encapsulating Suit Level B, C, D	Reusable or disposable one-piece suit. Typically disposable suits are coated with polymer to increase chemical permeation resistance. Provides splash and some sustained chemical contact protection, some thermal protection, and some abrasion protection. Reusable suits provide sustained chemical resistance when the polymer of construction is appropriately selected.	
Total Encapsulating Suit Level A	Reusable or disposable one-piece suit. Always coated with polymer or constructed of polymer. Provides maximum degree of chemical permeation resistance. Provides some thermal protection and abrasion protection. The suit is airtight thus requiring breathing-grade supplied air to be provided into the suit.	
Laboratory apron	Apron provides protection from abrasion and splash to front of body, where the maximum potential for exposure occurs. Should be used in conjunction with a lab coat, coverall, or other protection for unprotected areas of the body. Typically manufactured in polyethylene (low cost), vinyl (flexibility and resistance to chemicals, fats, oils, grease, etc.), and rubberized fabric (acid resistant).	

1A: Types of Protective Equipment

Equipment Title	Description	Illustration
Flame-resistant clothing	Suit worn for minor electrical operations for protection from accident hazards that create a hot metal. Protective clothing includes shirts, pants, coveralls, jackets, and parkas worn routinely by workers who, under normal working conditions, are exposed to momentary electric arc and related thermal hazards. Arc- and flame-resistant rainwear worn in inclement weather is included in this category of clothing. Layering of flame-resistant and natural fiber garments is used for added protection. A typical layering system may include an undershirt, a shirt, trouser, and coverall. Loose fitting clothing provides additional thermal insulation due to air spaces.	
Electrical flash suit	Suit worn by electricians for protection from electrical flash accidents hazards that create a large fireball, sending hot metal flying through the air. ASTM F1506-00 is used to assign the garment with an arc rating. Face shields made of polycarbonate material are more appropriate for use in situations with relatively low radiation exposure.	
Gauntlets/sleeves	Gauntlets provide protection from abrasion to the forearms, for uses where the maximum potential for exposure occurs in that area. Typical uses are chain saws and knife cutting operations.	

1B: *ELECTRICAL Safety Hazard Body Protective Equipment*

Clothing Material Characteristics:

- Flame-retardant treated cotton, meta-aramid, para-aramid, and poly-benzimidazole (PBI) fibers provide thermal protection.
- Synthetic materials, such as polyester, nylon, and synthetic-cotton blends will melt into the skin when exposed to high temperatures and aggravate the burn injury. Clothing made from synthetic materials such as acetate, nylon, polyester, rayon, either alone or in blends with cotton, should not be worn.
- Cotton and polyester-cotton, silk, wool, and nylon fabrics are flammable. Flame-retardant treated cotton, meta-aramid, para-aramid, and PBI fabrics may ignite but will not continue to burn after the ignition source is removed. Clothing made from natural materials, such as cotton, wool, or silk is acceptable if it is determined by flash hazard analysis that the fabric will not ignite and continue to burn under the arc conditions to which it will be exposed. NOTE: The weight of the fabric is a factor in meeting this requirement.

Table 3-3.9.1 Hazard Risk Category Classifications

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category	V-rated Gloves	V-rated Tools
Panelboards rated 240 V and below – Notes 1 and 3	—	—	—
Circuit breaker (CB) or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	0	N	N
Work on energized parts, including voltage testing	1	Y	Y
Remove/install CBs or fused switches	1	Y	Y
Removal of bolted covers (to expose bare, energized parts)	1	N	N
Opening hinged covers (to expose bare, energized parts)	0	N	N
Panelboards or Switchboards rated >240 V and up to 600 V (with molded case or insulated case circuit breakers) – Notes 1 and 3	—	—	—
CB or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
600 V Class Motor Control Centers (MCCs) – Notes 2 (except as indicated) and 3	—	—	—

CB or fused switch or starter operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch or starter operation with enclosure doors open	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized parts >120 V exposed	2*	Y	Y
Insertion or removal of individual starter "buckets" from MCC — Note 4	3	Y	N
Application of safety grounds, after voltage test	2*	Y	N
Removal of bolted covers (to expose bare, energized parts)	2*	N	N
Opening hinged covers (to expose bare, energized parts)	1	N	N
600 V Class Switchgear (with power circuit breakers or fused switches) — Notes 5 and 6	—	—	—
CB or fused switch operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category	V- rated Gloves	V- rated Tools
CB or fused switch operation with enclosure doors open	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized parts >120 V exposed	2*	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	3	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	2	N	N
Application of safety grounds, after voltage test	2*	Y	N
Removal of bolted covers (to expose bare, energized parts)	3	N	N

Opening hinged covers (to expose bare, energized parts)	2	N	N
Other 600 V Class (277 V through 600 V, nominal) Equipment — Note 3	—	—	—
Lighting or small power transformers (600 V, maximum)	—	—	—
Removal of bolted covers (to expose bare, energized parts)	2*	N	N
Opening hinged covers (to expose bare, energized parts)	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Application of safety grounds, after voltage test	2*	Y	N
Revenue meters (kW-hour, at primary voltage and current)	—	—	—
Insertion or removal	2*	Y	N
Cable trough or tray cover removal or installation	1	N	N
Miscellaneous equipment cover removal or installation	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Application of safety grounds, after voltage test	2*	Y	N
NEMA E2 (fused contactor) Motor Starters, 2.3 kV through 7.2 kV	—	—	—
Contactor operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
Contactor operation with enclosure doors open	2*	N	N
Work on energized parts, including voltage testing	3	Y	Y

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category	V- rated Gloves	V- rated Tools
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized parts >120 V, exposed	3	Y	Y
Insertion or removal (racking) of starters from cubicles, doors open	3	N	N
Insertion or removal (racking) of starters from cubicles, doors closed	2	N	N
Application of safety grounds, after voltage test	3	Y	N
Removal of bolted covers (to expose bare, energized parts)	4	N	N

Opening hinged covers (to expose bare, energized parts)	3	N	N
Metal Clad Switchgear, 1 kV and above	—	—	—
CB or fused switch operation with enclosure doors closed	2	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch operation with enclosure doors open	4	N	N
Work on energized parts, including voltage testing	4	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	2	Y	Y
Work on control circuits with energized parts >120 V, exposed	4	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	4	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	2	N	N
Application of safety grounds, after voltage test	4	Y	N
Removal of bolted covers (to expose bare, energized parts)	4	N	N
Opening hinged covers (to expose bare, energized parts)	3	N	N
Opening voltage transformer or control power transformer compartments	4	N	N
Other Equipment 1 kV and above	—	—	—
Metal clad load interrupter switches, fused or unfused	—	—	—
Switch operation, doors closed	2	N	N
Work on energized parts, including voltage testing	4	Y	Y
Removal of bolted covers (to expose bare, energized parts)	4	N	N

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category	V- rated Gloves	V- rated Tools
Opening hinged covers (to expose bare, energized parts)	3	N	N
Outdoor disconnect switch operation (hookstick operated)	3	Y	Y
Outdoor disconnect switch operation (gang-operated, from grade)	2	N	N

Insulated cable examination, in manhole or other confined space	4	Y	N
Insulated cable examination, in open area	2	Y	N

Legend:

V-rated Gloves are gloves rated and tested for the maximum line-to-line voltage upon which work will be done.

V-rated Tools are tools rated and tested for the maximum line-to-line voltage upon which work will be done.

2* means that a double-layer switching hood and hearing protection are required for this task in addition to the other Hazard/Risk Category 2 requirements of Table 3-3.9.2 of Part II.

Y = yes (required)

N = no (not required)

Notes:

1. 25 kA short circuit current available, 0.03 second (2 cycle) fault clearing time.

2. 65 kA short circuit current available, 0.03 second (2 cycle) fault clearing time.

3. For < 10 kA short circuit current available, the Hazard/Risk Category required may be reduced by one Number.

4. 65 kA short circuit current available, 0.33 second (20 cycle) fault clearing time.

5. 65 kA short circuit current available, up to 1.0 second (60 cycle) fault clearing time.

6. For < 25 kA short circuit current available, the Hazard/Risk Category required may be reduced by one Number.

Protective Clothing and Personal Protective Equipment (PPE) Matrix

Protective	Protective Systems for Hazard/Risk Category					
Hazard/Risk	-1	0	1	2	3	4
Untreated Natural	—	—	—	—	—	—
a. T-shirt (shortsleeve)	X			X	X	X
b. Shirt (longsleeve)		X				
c. Pants (long)	X	X	X	X	X	X
FR Clothing	—	—	—	—	—	—
a. Long-sleeve			X	X	X	X
b. Pants			X	X	X	X
c. Coverall			(Note 5)	(Note 7)	X	(Note 9)
d. Jacket, parka,			AN	AN	AN	AN
FR Protective	—	—	—	—	—	—
a. Flash suit						X
b. Flash suit						X
Head protection	—	—	—	—	—	—

Head protection	—	—	—	—	—	—
a. Hard hat			X	X	X	X
b. FR hard hat liner					X	X
Eye protection	—	—	—	—	—	—
a. Safety glasses	X	X	X	AL	AL	AL
b. Safety goggles				AL	AL	AL
Face protection double-layer switching hood				AR (Note 8)	X	X
Hearing protection (ear canal inserts)				AR (Note 8)	X	X
Leather gloves (Note 2)			AN	X	X	X
Leather work shoes			AN	X	X	X
Hazard/Risk Category Number	-1 (Note 3)	0	1	2	3	4

Legend:

AN = As needed

AL = Select one in group

AR = As required

X = Minimum required

Notes:

1. See Table 3-3.9.3. (ATPV is the Arc Thermal Performance Exposure Value for a garment in cal/cm2.)

2. If voltage-rated gloves are required, the leather protectors worn external to the rubber gloves satisfy this requirement.

3. Class -1 is only defined if determined by Notes 3 or 6 of Table 3-3.9.1 of Part II.

4. Regular weight (minimum 12 oz/yd2 fabric weight), untreated, denim cotton blue jeans are acceptable in lieu of FR pants. The FR pants used for Hazard/Risk Category 1 shall have a minimum ATPV of 5.

5. Alternate is to use FR coveralls (minimum ATPV of 5) instead of FR shirt and FR pants.

6. If the FR pants have a minimum ATPV of 8, long pants of untreated natural fiber are not required beneath the FR pants.

7. Alternate is to use FR coveralls (minimum ATPV of 5) over untreated natural fiber pants and T-shirt.

8. A double-layer switching hood and hearing protection are required for the tasks designated 2* in Table 3-3.9.1 of Part II.

9. Alternate is to use two sets of FR coveralls (each with a minimum ATPV of 5) over untreated natural fiber clothing, instead of FR coveralls over FR shirt and FR pants over untreated natural fiber clothing.

Protective Clothing Characteristics

Typical Protective Clothing Systems

Category	given in parentheses)	(ATPV) * or Breakopen Threshold Energy (EBT) * Rating of PPE cal/cm2
0	Untreated cotton (1)	4.5 – 7
1	FR shirt and FR pants (1)	4.5 – 8
2	Cotton underwear plus FR shirt and FR pants (2)	9 – 12
3	Cotton underwear plus FR shirt and FR pants plus FR coverall (3)	16 – 20
4	Cotton underwear plus FR shirt and FR pants plus double layer switching coat and pants (4)	24 – 30
		N/A
		5
		8
		25
		40

*ATPV is defined in the ASTM P S58 standard arc test method for flame resistant (FR) fabrics as the incident energy that would just cause the onset of a second-degree burn (1.2 cal/cm²). EBT is reported according to ASTM P S58 and is defined as the highest incident energy that did not cause FR fabric breakopen and did not exceed the second-degree burn criteria. EBT is reported when ATPV cannot be measured due to FR fabric breakopen.

Hazard Risk Category 2: This protection level could be obtained with cotton underwear plus FR shirt and FR pants or FR shirt and FR pants plus single layer 4.6 - 9.8 oz. Weave in the form of coverall or lab coat.

Hazard Risk Category 3: This protection level could be obtained with cotton underwear plus FR shirt and FR pants plus FR overall, or FR shirt and FR pants plus single layer 9.8 oz. coverall or 13 oz. FR coat. Face protection would require safety glasses or goggles plus double layer switching hood.

Hazard Risk Category 4: This protection level could be obtained with cotton underwear plus FR shirt and FR pants plus either 31 cal/cm², 50 cal/cm² or 100 cal/cm² double-layer switching jackets and pants plus 50 cal/cm² or 100 cal/cm² double layer switching hood. Safety glasses or goggles are still required.


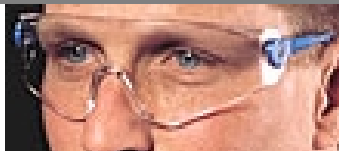

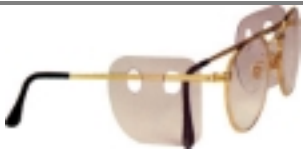

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2. Eye and Face Protection




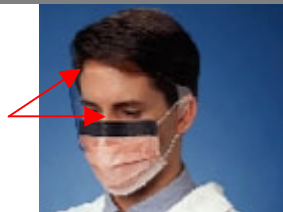


If you have any questions about the appropriate type of protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments*.

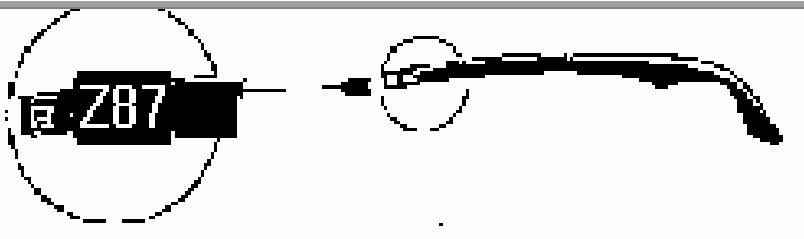
2A: Types of Eye Protective Equipment

Equipment Title	Description	Illustration
Non-safety eye glasses	Includes any glasses without impact resistance lenses and safety design features. Lenses insert into frame from the face (eye) side to minimize the thickness of the frame viewed by others or lenses attach to frame with minimal anchoring mechanisms. Because of these features to enhance the cosmetic appearance, on impact, the lens may disengage from the frame and move toward eye causing injury. The lens is less impact resistant and may fragment on impact causing eye injuries.	
Impact resistant safety glasses with side shields	Lenses insert into frame from the outside with a solid rim on the inner side of frame smaller than the lens. Design may include the lens and frame as one piece. On impact with a flying object, the lens will not disengage toward eye. The material of the lens meets impact resistant standards with built in or add-on clear side shield that guard against impact of flying objects entering from the side of the face. Marked as meeting ANSI Z87.1 standards.	
Prescription lens safety glasses with side shields	Same as above with corrective prescription lenses.	
Add-on side shields	Add-on clear side shield that guard against impact of flying objects entering from the side of the face. Marked as meeting ANSI Z87.1 standards.	
Visitor glasses	Impact Resistant Safety Glasses designed to fit over non-safety glasses. (Red frames glasses in picture are the visitor glasses). Marked as meeting ANSI Z87.1 standards.	
Vented goggles	Frame makes full contact with the face at all points. Vents in frame allow perspiration to vent reducing fogging. The material of the lens meets impact resistant standards. Marked as meeting ANSI Z87.1 standards.	

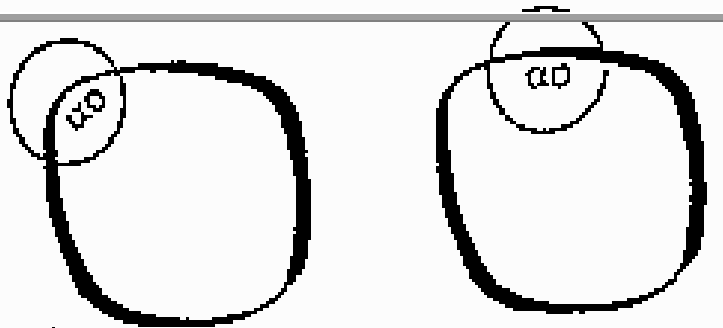
2A: Types of Eye Protective Equipment

Equipment Title	Description	Illustration
Non-vented goggles	Frame makes full contact with the face at all points. No vents in frame prevent entry of hazardous vapors, mists, fumes or aerosols. The material of the lens meets impact resistant standards. Marked as meeting ANSI Z87.1 standards.	
Face shield	Face shield has impact resistant crown and window for protection from flying particles. Marked as meeting ANSI Z87.1 standards.	
Full-face respirator	Face piece makes full contact with the face at all points. No vents in facepiece prevent entry of hazardous vapors, mists, fumes or aerosols. The material of the lens meets impact resistant standards. Marked as meeting ANSI Z87.1 standards. See the Respiratory Protection Subject Area. Acceptable for uses requiring safety glasses, face shield, and non-vented or vented goggles.	
Biohazard face masks	Shield provides droplet barrier for added security against bloodborne pathogens. Provides protection from biohazard splashes as well as both inhaled and exhaled microorganisms. Filters particulate matter at greater than 95% efficiency.	
Welding helmet	Provides multiple types of protection (eye and face protection). Acceptable for uses requiring safety glasses or face shield.	
Combo hard hat and face shield respirator	Provides multiple types of protection (head, respiratory, and face protection). Acceptable for uses requiring safety glasses or face shield.	
Electrical flash eye protection	Safety glasses and goggles provide lesser protection, but in low risk tasks they may be justified if the task involves substantial physical work in combination with good visual requirements. Eye protection (safety glasses or goggles) is worn under face shields or hoods.	

2B. Markings for ANSI-Compliant Eye Protection



ANSI-Required Frame Marking



ANSI-required lens marking (manufacturer's insignia)



ANSI-required side shield marking

2C. Filter Lenses for Protection Against Radiant Energy

Type of Operation	Electric Size 1/32 in.	Arc Current (Amp)	Minimum Protective Shade ^(a)
Shield metal arc welding	Less than 3	Less than 60	7
	3 to 5	60 to 160	8
	5 to 8	160 to 250	10
	More than 8	250 to 500	11
Gas metal arc welding and flux-cored arc welding		Less than 60	7
		60 to 160	10
		160 to 250	10
		250 to 500	10
Gas tungsten arc welding		Less than 50	8
		65 to 150	8
		150 to 500	10
Air carbon arc cutting	(light)	Less than 500	10
	(heavy)	500 to 1000	11
Plasma arc welding		Less than 20	6
		20 to 100	8
		100 to 400	10
		400 to 800	11
Plasma arc cutting	Light ^(b)	Less than 300	8
	Medium ^(b)	300 to 400	9
	Heavy ^(b)	400 to 800	10
Torch brazing		NA	3
Torch soldering		NA	2
Carbon arc welding		NA	14

Type of Operation	Plate Thickness		Minimum Protective Shade ^(a)
	Inches	Mm	
Gas welding			
Light	Under 1/8	Under 3.2	4
Medium	1/8 to 1/2	3.2 to 12.7	5
Heavy	Over 1/2	Over 12.7	6
Oxygen cutting			
Light	Under 1	Under 25	3
Medium	1 to 6	25 to 150	4
Heavy	Over 6	Over 150	5

Source: OSHA 29 CFR 1910.133 Personal Protective Equipment, Eye and face protection

(a) As a rule of thumb, start with a shade that is too dark to see the weld zone. Then, go to a lighter shade that gives a sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding or cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation.

(b) These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.

Laser Operations	See the Laser Safety Subject Area
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3. Fall Protection

If you have any questions about the appropriate type of body protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.



For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments*.

Employees who work on elevated surfaces or scaffolding are required to utilize a method of fall protection. Fall protection may include railings, barrier markings, or personal fall-arrest systems. Employees who use personal fall-arrest systems such as body harnesses, lanyards, and hoists should be trained in the proper usage of this equipment.






- **A fall-restraint system** is the equipment used to keep a worker from reaching a potential fall point. Fall restraint includes the use of perimeter cables, guardrails, floor opening covers, scaffolds or work platforms with standard guardrails, or the utilization of a safety harness and lanyard secured to an anchorage point restricting the worker from a fall hazard.
- **A fall-arrest system** is the equipment used to protect a worker from falling more than six feet or from striking a lower object in the event of a fall. This equipment always includes a full-body harness.

Before starting work above any elevation greater than 6 feet, it is recommended that a fall-protection work plan be developed. Use fall protection at any elevation greater than 6 feet.

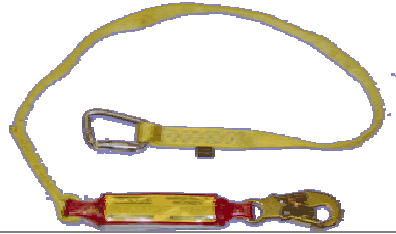

3A: Types of Protective Equipment

Equipment Title	Description	Illustration
Harness with front D-rings	A full-body harness distributes the forces generated during a fall over at least the thighs, pelvis, chest, and shoulders. Front D-ring for ladder climbing, positioning, suspension, rescue, or restraint.	
Harness with back and side D-rings	A full-body harnesses distribute the forces generated during a fall over at least the thighs, pelvis, chest, and shoulders. The standard sliding back D-ring helps to suspend a fallen worker in an upright position after the fall. Must meet or exceed all OSHA and ANSI standards including ANSI Z359.	

3A: Types of Protective Equipment

Equipment Title	Description	Illustration
Fall-protection coveralls	OSHA compliant full-body harness permanently incorporated into coverall. The coveralls come in a range of sizes and since the harnesses is sized to the coverall, no adjustment or adjusting hardware is needed. Inside the coverall, there are no loose straps, making donning fast and simple. A chest pocket holds the lanyard when not in use.	
Fall-protection overalls	Overall is lightweight enough to be worn in almost any climate and features the fall protection of an OSHA compliant polyester full-body harness. The overall is available in a range of sizes and requires only minimal adjustment since the harness is sized to fit the overall. Quick connect buckles at the shoulder straps makes donning fast and simple. The energy-absorbing lanyard fits in a specially designed pocket at the center of the wearer's back. A chest pocket holds the snap hook and web lanyard when not in use.	
Wristlets with yoke lanyard	Wristlets and yoke lanyard are designed for use in confined spaces or tanks with narrow openings where the worker may have to be withdrawn. Each wristlet has a permanently attached 1" wide x 6' long (3' each leg) polyester web yoke lanyard with a D-ring in the center.	
Rope grab system	Rope grab system includes lifeline, rope grab, flexible counterweight, shock absorbing lanyard and tie-off adapter.	
Self-retracting lifeline	Housing with lifeline. Swiveling anchorage loop to prevent twisting of lifeline. Swiveling self-locking snap hook with impact indicator.	

3A: Types of Protective Equipment

Equipment Title	Description	Illustration
Tieback lanyard	Energy absorber with dual layer polyester web tieback lanyard. An integral locking snap hook for attachment to your full-body harness and a captive automatic locking carabiner is fitted at the opposite end for attaching to a suitable anchor. Designed to reduce the possibility of serious injury by reducing the arresting force on a worker to less than 900 lbs.	
Decelerator lanyard	An energy absorbing inner core made of polyester absorbs the arresting forces in the case of a fall while the nylon outer shell protects the core from damage and acts as backup.	

4. Foot Protection

If you have any questions about the appropriate type of body protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments*.


4A: Types of Protective Equipment

Equipment Title	Description	Illustration
Casual, open-toed footwear	No impact resistance. None to minimal protection from contact, providing little to no protection from initial brief contact with chemicals and hot objects.	
		
Enclosed footwear (substantial)	<p>No impact resistance. Minimal protection from contact, providing some protection from initial brief contact with chemicals and hot objects. Worn with socks.</p> <p>Not for use in impact potential areas or for material handling.</p>	
Safety shoe (impact resistant, safety toe)	Structured steel cap capable of withstanding 2500 lbs. of compression. ANSI I-75 for absorbing impact and C-75 for compression. Typically full-grain leather or vinyl uppers, durable nonmarking slip-resistant outsole. Cut, falling object, and impact protection. Worn with socks.	
Metatarsal protection	High impact and falling object protection. Provides protection for front and bridge of foot. Worn with socks.	

4A: Types of Protective Equipment

Equipment Title	Description	Illustration
Dielectric boot	Dielectric – typically 20,000-volt overshoe with adjustable side lace, pole climbing reinforcement patch, antiskid bar tread and heel. Uninsulated. Ideal for utility, power transmission, and horizontal drilling applications. Worn with socks.	
Conductive sole shoe	Resistance range typically under 10,000 ohms for compliance with the ANSI Z41-1999 CD Type 1 standard for conductive shoes.	
Conductive shoe covers	Antistatic covers for footwear.	
Shoe cover	Contaminant protection worn over “enclosed footwear” or safety toe shoe, as appropriate.	
Disposable boot	Boot cover with elastic top, used for particulates including asbestos, lead dust and radioactive dusts. Worn over “enclosed footwear” or safety toe shoe, as appropriate.	
Chemical resistant overboot	Offers protection for hazardous and non-hazardous materials. Seamless waterproof covers provide added layer of chemical and wear protection. Worn over “enclosed footwear” or safety toe shoe, as appropriate.	
Chemical resistant boots with safety toe	Neoprene or other polymer boots are seamless with suction gripping tread pattern for slick floors, cushion insoles. Good against the broadest variety of animal and vegetable fats and fluids as well as the harshest of petrochemical substances. Worn with socks.	

4A: Types of Protective Equipment




Equipment Title	Description	Illustration
Electrical flash foot protection	Heavy-duty leather work shoes normally provide a significant degree of protection to the feet.	

5. Hand Protection




If you have any questions about the appropriate type of **hand** protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments*.

5A: Types of Protective Equipment

Equipment Title	Description	Illustration
Splash glove	Disposable, nitrile or natural rubber, ambidextrous gloves are resistant to a broad range of chemicals for brief periods. BNL policy is to dispose of immediately on contact with liquid unless manufacturer rates for sustained contact.	
Sustained contact and immersion glove	Superior chemical and abrasion resistance. For harsh cleaners and solvents, embossed grip, typically flocked or fabric lined, usually 10 to 20-mil thick. Material of construction must be impervious to the challenge chemical. See Table 5C.	
Cryogen glove	Asbestos-free and water-resistant, gloves protect against injury from both cryogenic and hot materials from -160° to 150°C (-260° to 300°F). Abrasion- and cut-resistant gloves let you confidently handle rough and sharp objects. Machine washable/dryable. Not for immersion in liquid nitrogen. Lighter in weight and more durable than comparable gloves.	

5A: Types of Protective Equipment

Equipment Title	Description	Illustration
Thermal burn-protection glove	<p>Woven fiberglass gloves withstand very low to very high (-70° to 600°C). Gloves are soft, flexible, and water resistant. Wool lining enhances user comfort. Aluminized gloves for extra heat reflectivity and molten-splash resistance.</p> <p>Ultra-high temperature Zetex® gloves offer the ultimate protection from intense, concentrated heat.</p> <p>Can also be used for cryogen liquid handling.</p>	
Abrasion resistance (a.k.a. work glove)	Typically a split leather palm, leather index finger and thumb and a leather knuckle strap. Cotton safety cuff.	
Cut-resistant glove	Heavyweight Kevlar-blend knitted gloves offer greater cut resistance than regular knit gloves	
Electrical flash hand protection	Gloves made from layers of flame resistant material provide the highest level of hand protection. Heavy-duty leather gloves also provide good protection. Where voltage-rated gloves are used, leather protectors should be worn over the rubber gloves. The leather protectors also provide good arc-flash protection for the hands.	

5B. Gloves and Suit Selection Process

The table below provides guidance in the selection of Chemical Protective Equipment for:

- SHSD IH Group
- RCD Facility Support Group
- ESH Coordinators and ESH professional in BNL organizations
- Scientists, Principal Investigators, and Workers (with competency in this area)

Steps in selecting an appropriate glove or suit

1	<p>Choose PPE only after alternative controls have been explored:</p> <ul style="list-style-type: none"> • Substitute a less hazardous chemical (if practical) • Use hoods, glove boxes, capture ventilation to control vapors, mists, liquids
2.	<p>Evaluate the job and type of exposure:</p> <ol style="list-style-type: none"> a. Chemical(s) involved (example: benzene) b. Duration of exposure (example: 20 minutes in constant contact with liquid) <ul style="list-style-type: none"> • How long will contact be in routine use and emergencies? Will the contact be immersion for long periods, splash, or incidental contact? • Chemical(s) attack on the glove (breakthrough time, permeation rate, degradation) must be shorter than the breakthrough time. Be sure to include cumulative time on re-used gloves. Refer to a Chemical-Resistant Table from the manufacturer or Table 5C for chemical-resistance ratings. <ul style="list-style-type: none"> • Breakthrough Time: The elapsed time between initial contact of the chemical on the glove surface and the analytical detection on the inside of the glove. When expressed with a greater than symbol (>), the test was run for "n" minutes and then stopped. • Degradation: A change in one or more of the physical properties of a glove due to contact with a chemical. Can appear as a swelling, softening, shrinkage or cracking of the material. A rating of "E" for excellent, means the glove has little or no signs of degradation when exposed to the challenge chemical. A favorable degradation rating does not guarantee an acceptable breakthrough time. • Permeation Rate: The rate at which a chemical passes through a glove material. This process involves absorption on the glove surface, the diffusion of the chemical through the material, and the desorption on the glove's inside surface. This measurement is given is $\mu\text{g}/\text{cm}^2/\text{minute}$, but is sometimes expressed as "E" to "P" for excellent to poor.

3	<p>Evaluate the material handling aspects of the job: The nature of the job being performed will greatly influence the selection and features of protective clothing. For example, analyzing samples in a laboratory may require light-duty gloves (<10 mils in thickness) that are flexible and have good manual dexterity; while a maintenance project, such as repairing a pump line, may require thicker gloves that are rugged and durable.</p> <p>Glove Dexterity - Will a bulky glove cause drops, accidents, or slips? Are small intricate parts handled?</p> <p>Select the appropriate glove thickness (example: single-use disposable gloves vs. reusable gloves)</p> <ul style="list-style-type: none"> • Select a thinner, unsupported glove when you require extra dexterity and tactile sensitivity. When a high degree of manual dexterity is needed with a hazardous substance, use of thin glove with limited protection time may be acceptable <i>if the gloves are changed with sufficient frequency</i>. • Select a heavier-gauge, unsupported glove for greater protection and wear. Consider a flock-lined, unsupported glove for extra comfort, insulation, and wear. <p>Choose the finish you need for the grip for your application: rough, smooth, wrinkle, embossed, bisque, etc.</p>
4.	<p>Evaluate the physical conditions the gloves will be subjected to and determine which types of resistance are important: abrasion, cut, puncture, temperature, etc. Physical conditions can influence chemical resistance. When possible, choose a supported or cut-and-sewn glove for added cut, snag, puncture, or abrasion resistance.</p>
5	<p>Size the glove:</p> <ul style="list-style-type: none"> • Select glove length by determining the depth to which your hand and arm will be immersed in a solution and the extent to which you need splash protection. • Select the hand size that gives you the right fit, dexterity and comfort. To determine your size, measure the circumference around the palm area. This is your glove size. For example, 7" is equal to a size 7 glove. (XS = 6-7, S = 7-8, M = 8-9, L = 9-10, XL = 10-11)
6	<p>Factor in the following</p> <ul style="list-style-type: none"> • Cost of the glove (example: Viton is very expensive). Does a cheaper glove have adequate properties? • Reuse of the glove (example: Can many cheaper disposable gloves be used in place of a more expensive reusable glove? • Storage and decontamination: Storing an exposed glove between uses can shorten the life of protection). Use of disposable gloves and clothing is often preferred, because proper decontamination of reusable items is often difficult.
7.	<p>Document the selection via</p> <ul style="list-style-type: none"> • Exhibit: PPE Selection Form; • SOP; • Work planning documentation; • Other Department/Division-developed mechanism.

5C. Polymer Selection Tables

The BNL [Safety & Health Services Industrial Hygiene](#) web page provides links to several manufacturer's web sites that provide polymer selection and ordering information.

The following table provides guidance for selecting the appropriate glove to be worn in situations involving chemical hazards. This table is not intended to be all-inclusive. If you have any questions about the appropriate type of glove required for your work activity, contact your immediate manager, Facility Support Representative, or the Personal Protective Equipment SME.

(Next page is landscape format)

Recommended Glove Material for common BNL laboratory chemicals

Chemical Name	Splash Protection (disposable, exam style)			Immersion & Sustained Contact						
	Nitrile (N-Dex, Purple Knight)	Natural Rubber (Latex Exam)	PVC	Disposable Nitrile (N-Dex) (unflocked and unsupported)				Reusable (typically flocked or fabric support)		
				DEGRADATION (MIN)				PERMEATION (MIN)		
				5	30	60	240	Break-thru time	Rate	
Acetonitrile	p	NR	NR	P	P	P	P	4		E= Butyl, Teflon, 4H
Acetic anhydride	NR	NR	NR	NR	NR	NR	NR	NR	NR	E= butyl, Teflon, 4H
ACIDS, dilute	E	F	F	E	E	E	E			Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Hydrochloric Acid 37%	E	F	F	E	E	E	E	ND	ND	E= Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Phosphoric Acid 85%	E	F	F	E	E	E	E	ND	ND	E= Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Viton, 4H
Nitric Acid 30-70%	G	NR	F	G	P	NR	NR	NR	NR	E= Butyl, Neoprene, Viton, 4H
Nitric Red Fuming	NR	NR	NR							E= Teflon
Sulfuric Acid 97%	G	NR	F	G	P	NR	NR	NR	NR	E= Butyl, Teflon, 4H, Viton
Acetic Acid 84%	E	F 1-4 HR	F 1-4 HR	E	P	P	NR	NR	NR	E= Butyl, Neoprene, Viton, 4H
ALKALI, dilute	G	F	F	F	F	F	F			Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Ammonium Hydroxide 30-70%	G	NR	P							E= Butyl, Neoprene, Nitrile, Teflon
Potassium Hydroxide (KOH) 45%	E	F	F	E	E	E	E	ND	ND	E= Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Sodium Hydroxide (NaOH) 50%	E	F	F	E	E	E	E	ND	ND	E= Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
ALCOHOLS	G	F	G							Butyl, Nat Rubber, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Ethanol	E	NR	NR	E	E	E	G	7	12	E= Butyl, Neoprene, Viton, 4H; F= Nitrile
Iso-propanol (2-propanol)	E	NR	F	E	E	E	E	15	29	E= Butyl, Neoprene, Nitrile, Teflon, Viton, 4H
Methanol	E	NR	NR	E	G	G	F	NR	NR	E = Butyl, Neoprene, Nitrile, Teflon, Viton, 4H
n-Propanol	G	NR	F	G	F	P	P	7	42	E = Butyl, Teflon, Viton, 4H
ALDEHYDES										
Acetaldehyde	NR	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, 4H, Teflon
Benzaldehyde	NR	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, PVA, Viton, 4H
Formaldehyde	E	NR	F	E	E	E	E	ND	ND	E= Butyl, Nitrile, Viton, 4H
Ammonia	NR	NT	NR	NR	NR	NR	NR	NR	NR	E= Butyl, Nitrile, Teflon, Viton
AROMATICS	F	NR	NR	NR	NR	NR	NR	NR	NR	PVA, Viton, 4H
Benzene	NR	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Teflon, Viton, 4H
Toluene	F	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Teflon, Viton, 4H
Xylene	F	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Teflon, Viton, 4H
CHLORINATED HYDROCARBONS	P	NR	NR	NR	NR	NR	NR	NR	NR	Butyl, Nitrile, PVA, Teflon, Viton, 4H
Carbon tetrachloride	F	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Viton, 4H
Chloroform	P	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Viton, 4H, Teflon
Methylene Chloride (dichloromethane)	F	NR	NR	NR	NR	NR	NR	NR	NR	E= PVA, Teflon, 4H
Trichloroethane, 1,1,1-	F	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, PVA, Viton, 4H

Chemical Name	Splash Protection (disposable, exam style)			Immersion & Sustained Contact						
	Nitrile (N-Dex, Purple Knight)	Natural Rubber (Latex Exam)	PVC	Disposable Nitrile (N-Dex) (unflocked and unsupported)				Reusable (typically flocked or fabric support)		
				DEGRADATION (MIN)				PERMEATION (MIN)		
				5	30	60	240	Break-thru time	Rate	
Trichloroethylene	F	NR	NR	NR	NR	NR	NR	NR	NR	E = PVA, Viton, 4H
DMF	P	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, Teflon, 4H
DMSO	E	NR	NR	E	G	F	P	23	84	E= Butyl, Neoprene, Teflon, 4H
EPOXY RESINS	G	P	F							Butyl, Neoprene, Nitrile, PVC, Teflon, Viton, 4H
Ethyl ether	G	NR	NR	G	G	G	G	2	495	E= PVA, 4H, Teflon
ESTERS	P	NR	NR	NR	NR	NR	NR			Butyl
Ethyl Acetate	P	NR	NR	NT	NT	NT	NT	NT	NT	E= PVA, Teflon, 4H; F= Butyl
Hydrazine	NT	F	G							E= Butyl, Neoprene, Nitrile, PVC
HYDROCARBONS/ PETROLEUM DISTILLATES	G	F	F							E= Butyl, Neoprene, Nitrile, PVC, PVA, Teflon, Viton, 4H
Hexane	E	NR	NR	E	E	E	E	11	8	E= Nitrile, PVA, Teflon, Viton, 4H
Hydrogen Peroxide 30-70%	G	G	G							Butyl, Nitrile, PVA, Viton, 4H
KETONES										Butyl, 4H
Acetone	NR	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, Teflon, 4H
Methyl Ethyl ketone	F	NR	NR	NR	NR	NR	NR	NR	NR	E= Butyl, Viton, 4H
Mercury	G	G	G	NT	NT	NT	NT	NT	NT	E = 4H Note: most gloves afford good protection
OILS, GREASE	E	E	E							E= Butyl, Neoprene, Nitrile, PVC, PVA, Teflon, Viton, 4H
PCBs	F	NR	NR							E = Viton
Tetrahydrofuran	F	NR	NR	NR	NR	NR	NR	NR	NR	E= Teflon, 4H

NR= not recommended ND= none detectable (permeation) NT = not tested NA = not applicable	E= excellent G = good F = fair P =poor	Butyl = butylenes/isoprene copolymer 4H = Silvershield = (polyethylene/ethylene vinyl alcohol copolymer) Natural rubber = isoprene from <i>gutta percha</i> Neoprene = DuPont trademark for chloroprene	PVA= tradename of Ansell for polyvinyl alcohol PVC= polyvinyl chloride Teflon = DuPont trademark for polytetrafluoroethylene (PTFE) Viton = DuPont trademark for hexafluoropropylene/vinylidene fluoride copolymer
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Source: Best Glove 4/98 Degradation/Permeation Table: Forsberg, Krister, & Mansdorf, S. Z. (1997). *Quick Selection Guide to Chemical Protective Clothing* (3rd ed.). New York: Van Nostrand Reinhold.

5D. BNL Guidance on “Splash Protection & Incidental Contact” for laboratory and fine detail work

Background: When selecting chemical protective gloves, a choice must be made regarding thickness and length. Thicker gloves have better chemical resistance than thinner gloves. However, thinner gloves offer better touch sensitivity and flexibility.

Glove thickness is stated in either mils or gauge. A 10-gauge glove equals 10 mils, or 0.010 inches. When choosing your glove, look for the stated thickness on the manufacturer's test data

Thin gloves sacrifice chemical resistance. Generally, doubling the thickness of a glove quadruples the breakthrough time of the chemical (more protective). Because surgical gloves are so thin, the material is easily stretched over the hand, allowing better sensitivity. But this stretching also leaves larger spaces in the glove material polymer. These larger spaces allow many chemicals to permeate through quickly, limiting the amount of time the glove can be worn. Some surgical gloves offer limited splash protection from some chemicals. But almost always, these gloves are not intended for complete immersion in chemicals, and should only be used for a very limited time period. Check the glove manufacturer's recommendations in regards to usage with your chemical.

BNL GUIDANCE

This BNL Guidance is applicable for gloves used in “fine detail” laboratory work for SPLASH PROTECTION & INCIDENTAL CONTACT (i.e., procedures where no contact or very little actual contact with a chemical in use is anticipated). It is NOT applicable where immersion is a factor.

1. Select the best disposable glove polymer - Nitrile, PVC, or natural rubber (Latex). When test data is not available, Nitrile is almost always the best choice.
2. If the glove has a “recommended” rating by the manufacturer (fair/good/excellent) for use with the chemical, use the glove within the guidelines provided by the manufacturer.
3. If breakthrough time (BT) is known, whenever the chemical is contacted always remove the glove sooner than the BT.
4. If BT is not known or the glove does not have a manufacturer's approval, wear the disposable glove with strong adherence to this policy:




“REMOVE THE GLOVE **INSTANTLY** WHEN CONTACTED BY A SPLASH or with RESIDUES of the chemical.”

6. Head Protection

If you have any questions about the appropriate type of body protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

For specific applications of the various equipment types to particular of work situations, see *Section 9: Generic and Specific Hazard Assessments*.

6A: Types of Protective Equipment

Equipment Title	Description	Illustration
Bump cap	Bump cap is extremely light in weight and features a replaceable suspension and sweatband. Popular where the possibility of a head bump or laceration is possible. Ideal for those working in areas with low head clearance. Four-point easily adjustable plastic suspension with perforated vinyl sweatband.	
Hard hat	A safety cap adjusts from head with 4 to 6-point nylon web suspension system. Hearing, welding, and face shield accessories should be able to be snapped into universal slots. Must meet or exceed OSHA and ANSI Z89.1 standards.	
Helmet respirator	Combination of PAPR respirator built into a safety cap adjusts from head with 4 to 6-point suspension system. Must meet or exceed OSHA and ANSI Z89.1 standards.	

7. Hearing Protection

If you have any questions about the appropriate type of hearing protection required for your work activity, contact your Supervisor or the Facility Support Representative, Industrial Hygiene (IH) Representative, or ESH Coordinator assigned to your organization.

Two main types of hearing protection devices are used to protect workers' hearing from noise in the workplace:

- 1) **earplugs** that are inserted into the ear canal; and
- 2) **earmuffs** that are worn over the head to cover the outer ear.

The ability of the hearing protection devices to attenuate (reduce) noise is expressed as a *Noise Reduction Rating (NRR)*. The higher the NRR, the more protection the device provides.

The NRR is a theoretical value. OSHA recommends adjusting the NRR to account for variability in the fitting of the devices to the individual. The formula for calculation of the adjusted NRR is:

$$\frac{(NRR_{(EPA)} - 7dB)}{2} = NRR_{(BNL)}$$

Example:





NRR on box of earmuffs is 29 dB

$$\frac{(29dB - 7dB)}{2} = \frac{22}{2} = 11 \text{ NRR}_{(BNL)}$$

Example: If a noise area is 93 dBA

Then: 93 dBA – **11 dBA NRR** = 82 dBA

7A: Types of Protective Equipment




Equipment Title	Description	Illustration
Earplugs	Soft, smooth foam is molded for maximum comfort, Tapered design with rounded tip aids insertion, typically NRR to about 29dB (field use NRR = 11 dB). Fit into and seal the ear canal; generally treated as "disposable" after each use.	
		
Banded plugs	High visibility headband for easy compliance checks, typically to NRR 22dB (field use NRR = 8 dB).	
Earmuffs	Soft ear cushions improve comfort, typically Dielectric design for use around electrical hazards, Noise Reduction Rating typically range for NRR 20 to 30 (field use NRR = 7 to 12 dB), tested in accordance with ANSI S3.19. Use when frequent removal and replacement of hearing protection is necessary.	
Noise cancellation muffs	Headphones that use a small microphone mounted in each earpiece to monitor the outside noise getting to the ear. A special electronic circuit then creates a signal perfectly opposite to the outside noise so as to cancel it out before it reaches the ear. Typically they are only able to reduce noise by about 10 dB over a limited frequency range. They cancel low frequencies best and typically do not cancel high frequencies effectively.	

8. Respiratory Protection








See the [Respiratory Protection](#) Subject Area for program requirements and required procedures.

For selection of Respiratory Protective Equipment, issuance of equipment, and cleaning and maintenance, contact the [RCD Facility Support Representative](#). (((Link)))




8A: Types of Respiratory Protective Equipment

Equipment Title	Description	Illustration
Disposable dust masks (filtering facepiece)	<p>The filtering media forms the facepiece to face seal. Used for non-hazardous dusts or worker convenience and comfort.</p> <p>Note: Not permitted for use at BNL in any situation in which a respirator is needed unless written consent is granted by the BNL Respiratory Protection Program Administrator (see the Point of Contact in the Respiratory Protection Subject Area).</p>	
Minimal use dust filtering mask	<p>Used for non-hazardous dusts or worker convenience and comfort. Polymer sealing surface fits user face.</p> <p>Note: Use is limited to operations with written consent is granted by the BNL Respiratory Protection Program Administrator (see the Point of Contact in the Respiratory Protection Subject Area).</p>	
APR half-face	<p>Air Purifying Respirator (APR) - Minimum level of protection at BNL for hazardous situations. Relies on cartridge media to clean the air that will be breathed.</p>	

8A: Types of Respiratory Protective Equipment

Equipment Title	Description	Illustration
APR - full face	Air Purifying Respirator (APR) - Moderate level of protection at BNL for hazardous situations. Relies on cartridge media to clean the air that will be breathed.	
PAPR - full face	Powered Air Purifying Respirator (PAPR) - higher level of protection than APR. Relies on cartridge media to clean the air that will be breathed. Air is pressurized by a blower into the mask. Selection of accompanying cartridge is made only by BNL Authorized Issuer.	
Welding helmet	Combines air purification with eye protection from the shaded lenses.	
Military mask	This mask is only for use by the Safeguards and Security Division at BNL.	
Gas mask	APR with high volume canister instead of a cartridge(s).	
PAPR helmet	Provides the minimum level of protection, only for particulates. Does not require a fit test.	
Supplied air hood	Provides clean air from a compressed air source-- either a bottle of Grade D breathing air or a compressor tested to provide Grade D breathing air. Does not require a fit test.	

8A: Types of Respiratory Protective Equipment

Equipment Title	Description	Illustration
Supplied air- full face	Provides clean air from a compressed air source-- either a bottle of Grade D breathing air or a compressor tested to provide Grade D breathing air.	
SCBA	Provides clean air from a compressed air bottle worn by the user. Permitted for use at BNL in situations in which an emergency device is needed. Use is limited to Emergency Services Division Fire Rescue Personnel and other allied organization in emergency response.	
Escape-bottled air pack	Provides a minimal amount of clean air from a compressed air bottle worn by the user. Used for escape only. Can be used for escape from oxygen-deficient areas.	

BNL Personal Protective Equipment Generic Hazard Assessments

Hazard Category Assessment of Hazard & Examples of Sources	Acceptable Equipment Specification		
	Body/Hand	Foot	Eye/Face/Head
Biological Exposure to infectious agent as aerosol or surface contaminant. Etiological agents, recombinant DNA, bloodborne pathogens, environmental biohazards (such as bird and rodent droppings)	Routine lab handling: Long pants or lab coat unless a specific hazard assessment has identified other levels of protection. Disposable protective glove when handling agents. Minor/incidental exposure: Long pants and long-sleeved shirt or long pants and lab coat. Severe exposure or exposure in an enclosed area (such as a crawl space or attic): Disposable protective coveralls (liquid-resistant material). Protective glove (such as nitrile or natural latex rubber).	Routine lab handling: Enclosed footwear unless a specific hazard assessment has identified other levels of protection. Minor/incidental exposure: Enclosed footwear. Severe exposure or exposure in an enclosed area: Biological-resistant shoe covers, boots, or overshoes.	Routine lab handling: Safety glasses with side shields. Minor/incidental exposure: Safety glasses with side shields. Severe Exposure or Exposure in an enclosed area: Non-vented goggles. (The face protection from a full-face or hooded respirator is also acceptable). Disposable protective head covering (hood, bonnet).

BNL Personal Protective Equipment Generic Hazard Assessments

Hazard Category Assessment of Hazard & Examples of Sources	Acceptable Equipment Specification		
	Body/Hand	Foot	Eye/Face/Head
Chemical Acid and chemical handling, degreasing, plating Chemical burn or irritation from splash or contact with irritating or corrosive vapors, dusts, mists, liquids.	Routine lab handling: Long pants lab coat unless a specific hazard assessment has identified other levels of protection. Disposable protective glove when handling hazardous chemicals. Minor/incidental exposure: Long pants and long-sleeved shirt or long pants and lab coat. Disposable protective glove. Severe exposure or exposure in an enclosed area: Long pants, lab coat and chemical apron, if adequate. Disposable protective coveralls (liquid-resistant material). Chemical protective glove (liquid-resistant material recommended by manufacturer)	Routine lab handling: Enclosed footwear unless a specific hazard assessment has identified other levels of protection. Minor/incidental exposure: Enclosed footwear. Severe exposure or exposure in an enclosed area: Chemical-resistant shoe covers, boots, or overshoes.	Routine lab handling: Safety glasses with side shields. Non-corrosive chemical handling: Safety glasses with side shields. No contact lenses (when lenses are soluble in the chemical) unless non-vented goggles also used. Splash with corrosive liquids: goggles, full-face or hooded respirator. (The face protection from a full face or hooded respirator is also acceptable). Irritating/corrosive mists: Non-vented goggles. (The face protection from a full-face or hooded respirator is also acceptable). No contact lenses unless non-vented goggles used. Disposable protective covering of chemical resistant material (hood, bonnet).

BNL Personal Protective Equipment Generic Hazard Assessments

Hazard Category Assessment of Hazard & Examples of Sources	Acceptable Equipment Specification		
	Body/Hand	Foot	Eye/Face/Head
Cryogen Thermal burn to eye, body, or face Handling liquid nitrogen or helium	Incidental contact: Long pants, long-sleeved shirt or lab coat. Heat glove or loose fitting leather glove. Pouring cryogen liquids: Long pants, long-sleeved shirt or lab coat, and apron. Heat glove or loose fitting leather glove.	Enclosed footwear.	Face shield or cryogen face shield
Electrical Electrical shock or electrocution Work around high voltage electrical sources in cabinets, equipment, power supplies, and transmission lines. >50V	Flash Hazard: See Appendix II: Permit for Working On or Near Energized Conductors in the ES&H Standard 1.5.0, Electrical Safety .	Skill of trade electric work: Electrical hazard (EH)-rated shoes (nonconductive).	Nonconductive (nonmetal) safety glasses with side shields or goggles.

BNL Personal Protective Equipment Generic Hazard Assessments

Hazard Category Assessment of Hazard & Examples of Sources	Acceptable Equipment Specification		
	Body/Hand	Foot	Eye/Face/Head
Impact/mechanical Abrasion, penetration, or other mechanical damage. Chipping, grinding, machining, masonry work, woodworking, sawing, drilling, machining, chiseling, power fastening, riveting and sanding Rolling objects, sharp objects, or falling objects.	Minor/incidental exposure: Long pants and long or short sleeved shirt or lab coat. Leather/cotton gloves when entrapment hazard will not be increased. Power tool cutting: Leather clothing (e.g., full aprons, kickback aprons, or leggings); or clothing made from cut-resistant material such as Kevlar.	Minor/incidental exposure: Impact resistant safety shoes or enclosed footwear with shoe caps. Moving heavy object with potential for impact: Safety shoes with metatarsal guards or enclosed footwear with metatarsal guards and shoe caps.	Minor/incidental exposure: Safety Glasses with side protection, goggles, or face shield. Work beneath elevated work: hardhat.
Ionizing radiation	See BNL Radiological Control Procedures and the Radiological Work Permits Subject Area.	See BNL Radiological Control Procedures and the Radiological Work Permits Subject Area.	See BNL Radiological Control Procedures and the Radiological Work Permits Subject Area.
Laser	See the Laser Safety Subject Area.	See the Laser Safety Subject Area.	See the Laser Safety Subject Area.

BNL Personal Protective Equipment Generic Hazard Assessments

Hazard Category Assessment of Hazard & Examples of Sources	Acceptable Equipment Specification		
	Body/Hand	Foot	Eye/Face/Head
Non-ionizing radiation UV, IR, ELF, VHF, radiofrequency, lamps and heating sources	Minor/incidental exposure: Long-sleeved shirt or lab coat when working with sources capable of causing skin burns	Minor/incidental exposure: Enclosed footwear.	Glare: Glasses with shaded lenses. Optical radiant sources: Tinted safety glasses with side shields or goggles appropriate for the frequency in use or as per: <ul style="list-style-type: none"> • Section 2C. Filter Lenses for Protection Against Radiant Energy in the BNL Exhibit: <i>BNL Handbook on Personal Protective Equipment Selection and Use</i> • Equipment manufacturer recommendations or BNL Non-Ionizing Radiation Subject Matter Expert assessment.
Thermal Burn to eye or face from hot sparks Ovens, open flames, heat lamps, furnaces operations, pouring, casting, hot dipping.	Minor/incidental exposure: Long pants and shirt or coveralls (cotton). Open flames: Long-sleeved shirt, lab coat, or insulated clothing and gloves (e.g., coveralls or jackets). Insulated clothing and gloves (e.g., aluminized material) for radiant heat extremes.	Minor/incidental exposure: Enclosed footwear. Severe exposure: Impact-resistant safety shoes or enclosed footwear with shoe caps.	Hot sparks: Face shields, goggles, safety glasses with side shields, welding helmet. Splash from molten metals: face shield worn over goggles, welding helmet. High-temperature exposure: screen or reflective face shield.

BNL Personal Protective Equipment Generic Hazard Assessments

Hazard Category Assessment of Hazard & Examples of Sources	Acceptable Equipment Specification		
	Body/Hand	Foot	Eye/Face/Head
<p>Welding/ brazing/ soldering/torch cutting</p> <p>Eye damage from radiant infrared and ultraviolet energy and burn from hot sparks or slag</p> <p>Arc welding, oxy cutting, torch brazing, torch soldering</p>	<p>Soldering-bench scale: Low-hazard protective clothing. Unless evaluated in an operation specific hazard assessment, casual dress clothing is not permitted in this setting.</p> <p>Welding/brazing/cutting: Apron, leggings, chaps, and spats made of fire-retardant cotton or aluminized fabric for exposed body parts.</p> <p>Severe exposure: Fire-retardant welders apron; leather or fire-retardant uniforms.</p> <p>Gloves (chrome tanned, split cowhide leather) are appropriate for use in soldering, brazing and welding applications. Zetex glove (aluminoborosilicate fiber) for high temperature applications, such as handling of heated metal pieces and brief exposure to a heat source or flame.</p>	<p>Impact-resistant safety shoes or enclosed footwear with shoe caps.</p> <p>Severe hazard: Leggings, chaps, and spats made of fire-retardant cotton or aluminized fabric.</p>	<p>Welding helmet or visor with lenses as per Table 2D. <i>Filter Lenses for Protection Against Radiant Energy</i> in the BNL Exhibit: <i>BNL Handbook on Personal Protective Equipment Selection and Use</i></p>

Project Information

Work Order#:	Job#:	Activity#:
Work Permit#:	ESR#:	RWP#:
Department:	Building:	Room/Area:
Scope of Work Contact Name:	Phone:	Pager:

Description of Area:

Description of Work to be done:

Hazard Information

Description of Hazard: (Including mechanism of generation of hazard)

Description of Potential Exposure:

☐ Required Use ☐ Voluntary Use ☐ Precautionary ☐ Accidental ☐ Emergency ☐ Routine
☐ Splash ☐ Immersion ☐ Nuisance Level ☐ Toxic ☐ Irritation

Radiological:

Isotope: _____ ☐ Particulate ☐ Gas

Chemical

☐ Lead ☐ Mercury ☐ Asbestos ☐ CHEMICAL:

Biological

☐ Biohazard Material ☐ Animal/Bird Droppings ☐ Bloodborne Pathogen ☐ Other:

Physical

☐ Burn (Heat) ☐ Cryogen ☐ Laser ☐ Fall/Slip
☐ Drop/Crush ☐ Cut/Abrasion ☐ Electrical ☐ Impact

Hazard Analysis:

☐ Calculation ☐ Analogy to Similar Work ☐ MSDS Review ☐ Tour of Area ☐ Other:
☐ Measurement ☐ Manufacturer Data ☐ Professional Judgment ☐ Published Info

Protective Equipment Selection

Eye:

☐ Safety Glasses ☐ Splash Goggles ☐ Gas-proof Goggles ☐ Face Shield
☐ Welding Shade#:
☐ Laser Shade#/ Type:

Hand:

☐ Glove Elastomer (material of construction): _____ Thickness: _____ mil
☐ Finger Cot BNL Stock#: _____ ☐ Disposable ☐ Reusable

Foot:

☐ Safety Toe ☐ Shoe Covers ☐ Boots ☐ Insulating ☐ Conductive

Body:

☐ Apron ☐ Lab Coat ☐ Suit (1 piece) ☐ Suit (2 piece) ☐ Hood/Cap
☐ Rain Wear ☐ Sleeves

Other:

☐ Fall Harness ☐ Hard Hat Other:

Authorization

Selection Made By:

Print

Signature

Date

BROOKHAVEN NATIONAL LABORATORY											
AUTHORIZATION FOR ISSUE OF ONE PAIR OF SAFETY SHOES OR SAFETY GLASSES – ISSUED AT BUILDING T-88											
A (TO BE COMPLETED BY SAFETY COORD.)				PROJECT NO. _____ ACTIVITY NO. _____ DATE _____							
ISSUE 1 PR. SAFETY (SHOES) (GLASSES) TO: EMPLOYEE'S NAME _____								WELDING _____			
CROSS OUT ONE GLASSES TO BE: (CLEAR) (TINTED)								BLDG. NO. _____			
DEPT. SAFETY COORDINATOR: _____								C (TO BE COMPLETED BY SHOE FITTER)			
B (TO BE COMPLETED BY OPTICIAN)								STYLE _____			
								SIZE _____			
								NOTE: ALL SPECIAL APPROVALS MUST BE AUTHORIZED BY THE DEPARTMENT'S SAFETY COORDINATOR _____			
								REMARKS _____			

								ISSUED FROM STOCK ON _____			
								-ON-			
								ORDERED FROM STOCK ON _____			
								ISSUED ON _____			
								PROF. SIG. _____			
POLYCARB <input type="checkbox"/> GLASS <input type="checkbox"/> PLASTIC <input type="checkbox"/> SPECIAL INSTRUCTIONS _____								D (TO BE COMPLETED BY EMPLOYEE)			
CLEAR GRAY BROWN GREEN ROSE OTHER TINT 1 2 3 %								REC'D. 1 PR. SAFETY (SHOES) (GLASSES)			
DISTANCE R SPH. CYL AXIS BASE IN (DEC) OUT								DATE _____			
								SIGNATURE _____			
ADD FOR NEAR R L MM MM								CONSULT SAFETY DEPT. FOR TINTS REQUIRED FOR WELDING, BRAZING LASERS, ETC.			
INTER-MEDIATE OR UPPER ADD R L MM MM								SPECIAL TINT: _____			
SAFETY GLASSES STYLE SIDESHIELDS BRIDGE SIZE: TEMPLE TYPE TEMP. LENGTH PD. NEAR FAR								SAFETY DEPT. OK: _____			
								ADDITIONAL FORMS MAY BE OBTAINED FROM STATIONERY STOCK ROOM, T-88 STOCK NO. S-80250			
PROFESSIONAL SIGNATURE _____											
ACCOUNTS PAYABLE FOR LABORATORY USE ONLY (WHITE)				SAFETY EQUIPMENT RECORDS (YELLOW)				VENDOR (Rx GLASSES OR SHOES) S & M (PLANO GLASSES) (PINK)			
								REQUISITIONER (GOLDEN ROD)			

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Definitions: Personal Protective Equipment

Effective Date: **November 2003**

Point of Contact: [Personal Protective Equipment Subject Matter Expert](#)


Term	Definition
operation-specific hazard assessment	Written documentation of hazard assessment, examples include the Protective Clothing Selection Form or Work Planning & Control documentation, SOP/ICD, or other suitable document that addresses hazards and the personal protective equipment (PPE) used to address the hazard.
personal protective equipment (PPE)	Clothing or equipment that is intended to protect the worker's body (including eyes, face, feet, hands, head, and hearing) from hazards capable of causing injury, illness, or impairment of any bodily function.

[Back to Top](#)

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Revision History: Personal Protective Equipment

Point of Contact: [Personal Protective Equipment Subject Matter Expert](#)

Revision History of this Subject Area

Date	Description	Management System
November 2003	<p>This subject area provides an overview of the BNL Personal Protective Equipment (PPE) Program and sets forth the elements to implement the regulatory requirements in OSHA Title 29 of the Code of Federal Regulations Part 1910.132 – 140.</p> <p>The purpose of this subject area is to establish requirements on personal protective equipment (for body, eye, face, head, foot, and hand) in operations with chemical, physical, or biological hazards. This subject area replaces ES&H Standard 1.16.0, Personal Protective Equipment.</p>	Worker Safety and Health

[Back to Top](#)

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